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**Electrical signaling in control of ocular cell behaviors.**

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**Public Summary:**

The authors review electrical control of cell migration, proliferation and division in the ocular tissues. They present evidence of the existence of electric fields in vivo. They discuss experimental results of application of electric fields of similar strength to the cells and the cellular responses ensured. Both endogenous electric fields and applied electric fields could be exploited to regulate ocular cells. The authors suggest possible clinical implications.

**Scientific Abstract:**

Epithelia of the cornea, lens and retina contain a vast array of ion channels and pumps. Together they produce a polarized flow of ions in and out of cells, as well as across the epithelia. These naturally occurring ion fluxes are essential to the hydration and metabolism of the ocular tissues, especially for the avascular cornea and lens. The directional transport of ions generates electric fields and currents in those tissues. Applied electric fields affect migration, division and proliferation of ocular cells which are important in homeostasis and healing of the ocular tissues. Abnormalities in any of those aspects may underlie many ocular diseases, for example chronic corneal ulcers, posterior capsule opacity after cataract surgery, and retinopathies. Electric field-inducing cellular responses, termed electrical signaling here, therefore may be an unexpected yet powerful mechanism in regulating ocular cell behavior. Both endogenous electric fields and applied electric fields could be exploited to regulate ocular cells. We aim to briefly describe the physiology of the naturally occurring electrical activities in the corneal, lens, and retinal epithelia, to provide experimental evidence of the effects of electric fields on ocular cell behaviors, and to suggest possible clinical implications.

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